

NOTES ON GLACIAL ACTION VISIBLE ALONG THE KITTATINNY OR BLUE MOUNTAIN, CARBON, NORTHAMPTON, AND MONROE COUNTIES, PENNSYLVANIA.

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My attention was first called to the fact of glaciers having existed along the Blue Mountain and south of it, from the vast deposits of boulders and pebbles south of the Lehigh Gap, and along the course of the Lehigh River. My observations have been limited, not having had time to devote to the subject.

South of the Lehigh Gap, about one-half mile below the chain bridge, on the east side of the river is a railroad cut through the slates of the Hudson River group, overlaid by a large bed of sands, gravel and boulders, having all the characteristics of a glacial deposit.

The slate has a dip to the southeastward, the upper edges of it are broken and crushed over to the southward, thus showing a force and weight moving in a southerly direction and obliging the slates to conform to it.

A similar exposure was observed three-fourths of a mile below Bowman's (second station above Lehigh Gap). Here in a railroad cut through the shale of VI, on the east side of the river, the rock is exposed for more than a hundred feet.

The rock dips S.20°E., the line of the exposure is S.40°E., and parallel to the exposure, or diagonally across the strike, are the edges of the shale overturned and broken, in some places to a depth of five or six feet. Here, too, the broken edges all incline to the southeastward, indicating the direction of the moving mass to be towards the Gap. The shale is very much crushed near the surface; above it is a heavy bed of fine sand, angular fragments of rock, and large boulders, most of them are from the Oriskany, some from the Chemung, but *none* from the Medina of the Blue Mountain.

Two hundred yards back of the Hotel at Bowman's, on the road to Fireline, the slates of the Hamilton present a similar appearance. The upper edges overturned and broken, and here show a movement to the southeastward.

We may conclude from these facts that the bed of the present river marks, to a great extent, the course of the glaciers.

To the east and west of the Gap, north of the mountain is a broad flat valley extending from the Oriskany Ridge to the base of the mountain. This valley is intersected by a barrier of debris extending from the Oriskany Ridge to a rounded hill of Clinton Shale and sandstone, a few hundred yards north of the Gap.

My attention was first called to this fact by Mr. H. Martyn Chance, who was then making a survey of the Gap.

The only explanation I can give of this, is, that it is a moraine formed

by the glacier after it had receded through the Gap, possibly a lateral moraine.

WIND GAP.

From the few evidences observed, I concluded that here, too, the glaciers had crossed the Blue Mountain Range. North of the Gap I observed nothing remarkable. South of the Gap are great numbers of boulders of Oneida conglomerate and Medina sandstone. They are strewn along for some distance in a direct line with the Gap, and apparently mark the course of a moving body.

Not having observed Oriskany sandstone associated with the boulders, I attributed to the fact of it being more easily disintegrated.

DELAWARE WATER GAP.

The first notice I took of decided glacial action in this vicinity, was about four miles from the mouth of Marshall's Creek, on the road to Craig's Meadow, where there are extensive exposures of the Oriskany sandstone, undulating and pitching gently to the northward.

These beds, often quite level, are scored and scratched wherever exposed. Often several hundred square feet are laid bare by the road.

The direction of these grooves is S.28°W., showing the direction of the moving mass to be towards the Gap. That the motion was to southward can clearly be seen wherever there are slight rises in the rock, the northern side is more deeply grooved, and more polished than immediately south of it. The full weight of the mass being forced against the rise would not act with the same force till it had passed some distance beyond.

The same fact as remarked in the White Mountains by Agassiz, (?) where the northern slopes of the mountains are scored and grooved to their very summits, but the scratches do not appear till near the base on the Southern slopes.

There are evidences of a moraine about one mile north of the mouth of Marshall's Creek, near the mill-dam.

In the neighborhood of Craig's Meadows are large deposits of drift, probably glacial.

West and southwest of the Gap, about two miles, I observed polished and grooved surfaces of the Medina.

South of the Gap are large deposits of gravel and boulders, evidently glacial debris.

Between the Gap and Broadhead's Creek I observed some beautifully defined terraces, but was unable to trace them. These facts tend to prove that the Gaps existed before the glacial epoch, and that the present rivers mark, to some extent, the courses of the ice, at any rate, towards the close of that period.